



# Republic Industries International

## Part II—Understanding Throughput

*Established in 1911, Republic Industries International repairs and produces large metal components supporting customers in the industrial and mining sectors. They also provide engineering services to develop unique solutions to meet customers' needs. Based in Louisville, Kentucky, Republic operates as a make-to-order and make-to-stock company with about 100 employees.*

### Summary from Part I

Prior to their journey with AGI—Goldratt Institute, Republic Industries International scheduled work using little more than a dashboard, and the only unbreakable rule was no time off during the last week of the month. When they *activated* their new operations management process, based on the Theory of Constraints (TOC) *strategy* and *design*, they saw a dramatic change in performance. In the first month, they reduced work-in-progress by 40% and increased finished goods by 27%. They had a much clearer understanding of their work flow and capacity. The changes in management and scheduling had stabilized their work environment and permitted them to focus on root causes rather than just symptoms. They saw their sales increase and recognized the potential to meet customer demand more frequently and convert lost sales into additional revenue. But they also knew their journey, as well as their understanding of throughput, had only just begun.

### The Need for Improve and Sustain

Regardless of how impressive short-term benefits appear to be, many organizations abandon, or scale back, their change initiatives when the policies, measures, and behaviors of the new process challenge old habits and long-held

assumptions. In addition, solutions often need further refining once they are in place to adapt to the unforeseeable realities of operating under new conditions. The *improve* and *sustain* stages of the SDAIS deployment framework address these issues to solidify a new system as the fully accepted way to do business. At Republic, their new operations management process soon came into conflict with some of their other business processes, in particular, their accounting procedures and efficiency measures. They also faced rapidly changing market conditions with significantly greater economic uncertainty. The outcome of these old-versus-new, and new-versus-newer, conflicts would determine the future of Republic Industries International.

The old-versus-new conflict became increasingly clear when, despite the increased velocity of work through their system to meet customer demand, the financial reports indicated decreasing profits. As senior management scrutinized the new operations management process to determine why they were not as profitable as expected, the key proponent of their TOC design (their Director of Supply Chain Management, who also had previous training and experience in accounting), called his AGI mentor for help. Among the recommendations was to read the

**VELOCITY**—a powerful business approach combining speed with direction—consists of three pillars: **Theory of Constraints**, the system architecture; **Theory of Constraints Lean Six Sigma** (TOCLSS), the focused improvement process; and **SDAIS** (*Strategy-Design-Activate-Improve-Sustain*), the deployment framework.

first two parts of *The Haystack Syndrome* and review how it addressed measurements. Based on the reading and his AGI TOC Supply Chain Technical Expert training, he quickly realized some of the fundamental problems with cost accounting, including issues as basic as how they measured “costs” and “profits.” He reflected on their accounting actions to revise some of their cost drivers for the new fiscal year. He was amazed at their level of “sophistication.” For example, one of their larger allocated expenses during the year was heating during the winter months; their building was a bad combination of being old and tall. Applying traditional cost accounting principles, they had computed the square footage of each machining area and allocated the heating costs. Their most expensive machines also had the largest footprint (such as the large mill in figure 1), so they naturally charged the highest cost per hour for these machines to reflect their depreciation and allocated costs. Based on these higher costs per hour,



**Figure 1. Expensive, large footprint mill— with high cost per hour because of depreciation and allocated overhead expenses**

if one of these machines was required, they would often outsource that work to minimize cost and boost their earnings. In the past, they even praised a production manager for this “cost efficiency.”

Armed with better logical analysis skills, the supply chain director asked the simple question, “Does an underutilized machine know not to use heat because it costs too much?” Despite his logic and other arguments regarding traditional cost accounting, senior management would not move away from the measures they were so accustomed to, insisting that most costs were not fixed—“A machine that runs will require consumables while one turned off does not.” Old habits die hard!

During this period, the supply chain director began to gain some allies. One of the accountants took an immediate interest in TOC, and he, too, read *The Haystack Syndrome* and some TOC accounting books. They often spoke in private about how to apply the concepts, originally written for companies that had repeatable production lines, to their repair environment. They invested hours designing a new approach, with the primary objective of overcoming a system that was forcing bad decisions because of *their* cost allocations.

The conversion was difficult. While conceptually they understood the only real difference between cost and throughput accounting was how they handled absorption in the inventory evaluations, their accounting system was deeply entrenched in allocations. Sorting out all the debits and credits to get their cost and throughput books to reconcile was incredibly challenging, but after several months they resolved the disparities to within a few hundred dollars. Finally, they were able to accurately express their

monthly results in throughput terms (figure 2) and compare them to their traditional cost accounting reports.

### Throughput Accounting Terms

**Throughput (T)** - The rate at which a system generates "goal units." If the goal units are money, throughput is calculated as revenues received minus totally variable costs divided by the chosen time period.

**Totally Variable Costs (TVC)** - those costs that vary one-to-one for every increase in the number of units produced, e.g., raw materials, commissions, per unit treatments, etc.

**Operating Expense (OE)** - money spent to generate "goal units" that do not vary with production/service volume, e.g., salaries, rent, insurance, etc.


**Investment (I)** - money currently tied up in the system, e.g., equipment, fixtures, buildings the system owns, including inventory in the forms of raw materials, work in process, and finished goods.

**Net profit (NP)** - throughput minus operating expense (T-OE).

**Return on Investment (ROI)** - throughput minus operating expense divided by investment; (T-OE)/I.

Figure 2. Throughput Accounting Terms

After a "stellar" month, the company's net profit, using costing accounting methods, was surprisingly disappointing. They thought they had just completed an outstanding month with record-breaking sales and shipments of both made-to-order and made-to-stock items. Morale was pretty low when they realized record-setting sales had yielded relatively meager profit. The next day, still stinging from the shocking news, they reviewed the same month in throughput terms. To their universal relief, they found they had generated three times the profit reported earlier, as a significant volume of their made-to-stock inventory was converted to delivered sales. While they didn't expect these results to be typical, production was no longer criticized for

building make-to-stock items with the same velocity as make-to-order items. One vital difference in their operations management was their made-to-stock finished goods closely matched the customers' demands. They had used the  **VELOCITY Suite™** ANALYZE capability to determine time-based inventory and production requirements using customer demand patterns. Judging by their seasonal historic performance, instead of a record lost sales month, they set a record volume in actual sales shipped.

### Accepting Throughput Accounting

After the owner and other senior managers heard the results presented in these terms, they embraced throughput accounting. Another unplanned advantage of the switch was the clarity and brevity of the reports. Using old cost measurements, their typical profit and loss report exceeded three pages using the smallest font they could read. By consolidating most of their cost items as operating expense, the new throughput profit and loss statement was only one page. The new reports made it easy to convey what went correctly and where they could make improvements without the distraction of the fixed expenses. For example, they no longer questioned their maintenance department's monthly spending on *mandatory* repairs. From then on, the company would switch their entire accounting information to throughput terms, and they would focus on real improvements, not just the ones that purportedly would reduce "costs."

Another surprising benefit was how these first throughput results changed their perceptions of their company. Republic gained a much clearer understanding of how their make-to-order and make-to-stock work contributed differently to their bottom line. Since their make-

to-order work traditionally used fewer labor hours per sales dollar than make-to-stock, Republic had perceived the make-to-order work to be the more profitable. In reality, the higher sales dollars for some of their make-to-order work went towards higher material costs—some of their blockbuster make-to-order sales jobs were little more than reselling material with only slight profits in throughput terms.

With this new information, Republic started to shift their priorities to jobs with the higher throughput per labor hour, rather than simply looking at gross sales dollars. This shift in priorities also challenged some of their old thinking and policies. In particular, they had always based their sales commissions on sales dollars. For the upcoming fiscal year, they had to carefully convince their sales staff why their incentives needed to be aligned with the company's bottom line measured in throughput terms. In addition, they had to re-think some opportunities they had categorized as "lost sales" (orders they were unable to fill because they lacked the finished goods in stock). Republic had perceived they had neither the products nor the resources to meet those customers' needs. The demand for these products was often much less predictable, both in terms of volume and frequency. In many cases, these customers required these products in less than the time required for Republic's make-to-order process. Consequently, Republic would have to build these products as make-to-stock; however, that meant purchasing expensive "cores" with significant impact on their cash flow. However, using throughput terms, they could see these "lost sales" opportunities were definitely worth pursuing. Moreover, their analysis showed they actually had the capacity to do so. With a better understanding of through-

put, Republic was able to successfully overcome their old thinking and progressively improve their new operations management process.

### ***New-versus-Newer: Opportunity Leads to More Change***

Even in the few months after their first changes to their management process, their market conditions, and the economy as a whole, continued to change. As the economy declined, the make-to-order demand for Republic's products dropped sharply. Losing those throughput dollars jeopardized the company's survival.

During this crisis, an unforeseen opportunity challenged their new operations process. One of Republic's customers had a crisis of their own. With long lead times and rising prices for steel, this customer wasn't able to meet its clients' demand and soon had significant backorders for a particular product that included a component from Republic. When that customer made a breakthrough that allowed them to produce in record amounts, they called on Republic to deliver their component as quickly as possible, or they would seek another source. Suddenly, Republic faced losing a customer, where they were the sole source supplier, if they could not deliver quickly. How would their "new" system be able to cope with "newer" conditions?

After reviewing their resource capacity, the supply chain director believed they had the necessary resources, but they would have to divert them from some other jobs to this product line. After comparing the products in throughput terms, they were convinced this opportunity would yield higher returns. With the experience, tools, and knowledge gained from the **VELOCITY** approach, and supported by throughput value calculations, they were able to analyze an oppor-

tunity, prove its business case, and receive permission to reassign resources in a new production schedule—all in a matter of hours instead of days. This speed of decision-making would have been unthinkable in their old system.

This speed was even more remarkable since this opportunity required a significantly different production approach from how they typically operated. While they had made this product in the past, their usual approach was to squeeze the product between their other jobs, with all the overtime they could manage, and in three-to-four weeks, they would deliver. However, the volume and rate in question represented an estimated 6-to-12 month delivery time—well beyond their customer’s tolerance. For this to succeed, they could no longer think like a repair shop; they had to design a production line.

### **DESIGN—Using the TOC Five Focusing Steps**

Using AGI’s TOC Supply Chain Management training, they designed the system architecture for this product using the Five Focusing Steps (figure 3). The supply chain director gathered the production supervisors and asked them how many resources they could make available to this one product if they removed all the other work from their areas. They were surprised to learn that, with some quick training and shift changes, they could more than double their capacity.

#### **The TOC Five Focusing Steps:**

1. **Identify** the system’s constraint.
2. Decide how to **exploit** the system’s constraint.
3. **Subordinate/synchronize** everything else to the above decisions.
4. **Elevate** the system’s constraint.
5. If in the above steps the constraint has shifted, go back to step 1. Do not allow **inertia** to become the system’s constraint.

Figure 3. The TOC Five Focusing Steps

Here was their process:

#### **1. Identify the system’s constraint.**

They had a ratio of seven lathes available to one welding station, so naturally they assumed the constraint was welding (figure 4). Also, when they chose to run large batches, the lathe department was always waiting on the weld shop to catch up. How-



Figure 4. Manual welding

ever, when they challenged the assumptions and analyzed all the true resource capacities, they were surprised to discover the lathe department was the constraint and batching would have wasted two production days every week.

#### **2. Decide how to exploit the system’s constraint.**

Republic exploited the constraint by setting up a series of buffers that protected the lathe department from ever running out of work, thus keeping the constraint busy at all times. To set up their production line, they had to tell their customer they would be late on the first delivery. They also changed their operations

to deliver weekly instead of monthly. They estimated shipping 22 items per week (88 per month), a 120% increase compared to their previous estimate of 40 per month (with no overtime).

### **3. Subordinate/synchronize everything else to the above decisions.**

This step required telling the area supervisors how much, and of what type, to produce each day, which was much easier in theory than in practice. Many skeptics, who didn't participate in the new production line design, continued to argue that breaking setups would only further reduce what they could produce and that running all the items in one large batch had to be the best solution. Since only some understood and accepted all the concepts involved, Republic needed strong leadership to enforce the new design until the results proved why a smaller batch was the best solution.

### **4. Elevate the system's constraint.**

Still needing additional capacity, they asked individuals in the lathe department if any would voluntarily work overtime for the next three months. Several agreed and their capacity increased yet again. This was significantly quicker, and less costly, than hiring and training new employees, especially for what they expected to be a temporary surge.

### **5. If in the above steps the constraint has shifted, go back to step 1. Do not allow inertia to become the system's constraint.**

Their constraint had not moved, despite adding additional lathe capacity. However, Republic recognized that having only one trained welder during the week was risky, so they decided to train another welder to protect the constraint.

## **ACTIVATE and IMPROVE—Deploying and Refining the New Design**

This entire approach took less than one day to develop, and they had effectively solved the problem. The following Monday, they eagerly applied the new design to their operations and experienced exactly the results they were expecting. This improved performance continued for a full month, when their customer told them that 22 per week would no longer be enough to meet their demand. On a Friday afternoon, their client set a deadline of 10:00 am the following Monday for Republic to provide a detailed proposal to deliver 44 units per week or they would need to look for another source.

Dismayed at the prospect of working all weekend, the supply chain director began by reassessing their production line design. The design had proven so effective he was reluctant to tamper with it. Nonetheless, having had such great success using the Five Focusing Steps, he retraced the experience. When he realized the additional welding person had just completed his training, he saw a breakthrough change to the design. This change would reduce the number of setups in the lathe department. In addition, if they re-hired a former experienced employee, they would be able to produce 40 items a week! Since this design was untested and allowing for some variability and the upcoming holidays, it seemed too optimistic to commit to this schedule. Therefore, he decided they could confidently promise 36 units per week. They would use the extra capacity to buffer for the expected, and unforeseen, problems. In less than three hours, he had a new design and was ready for his first face-to-face meeting with their customer.


The next Monday, the supply chain director and their sales representative made the three-

hour trip to present their proposal. Their anxiety, already high because they knew their promised delivery was still less than what the customer wanted, increased even more when they entered a large room with many of the customer's senior executives and most of its purchasing staff. Republic shared their production design and promised they could produce 36 units a week starting the next week—an increase of nearly 64%. Skeptical of the claim, the customer countered, if 36 was the promised quantity, they could not accept the likelihood that in some weeks fewer than 36 would be delivered. Republic's director replied that was why they were only promising 36. He fully believed they had the capacity for 40 per week, but knew they might need this protective capacity during the course of the project to handle variations. The customers' executives gave a nod of approval and just like that, the meeting was over. They all went out to lunch with the prospect of engaging in a long-term contract, if Republic did what they had promised.

### **SUSTAIN—Strategic Bottom Line Results**

A few months later, that sales representative came back to the plant saying in all his years, he had never received a welcome from a customer like the one he received that day. The customer's

executive said, "You said it, but I never really expected it! You all did exactly what you promised and I am told that you did not miss a single delivery, regardless of the winter holiday, or statewide power outages! Thank you; please take this long-term contract back with you for your president to sign." Understanding throughput and applying the **VELOCITY** approach enabled Republic Industries International to focus their system improvements—rapidly redesigning their operations and increasing their production to meet a new strategic opportunity.

With all of these improvements, Republic was on a path of prosperity and built a strong plan to not only survive the economic downturn, but to grow as a company. However, as planning goes, even Republic was not ready for the steeper-than-expected economic decline. Again, they faced the challenge of finding new business opportunities to sustain their profitably. These opportunities, with a new customer base intolerant of late deliveries, forced Republic to make more changes to how they managed large projects. See how they used the MANAGE Capability of the  **VELOCITY Suite™** to surmount this challenge in their next case study, *Republic Industries: Part III—Improving Delivery Performance*.

Source: Jason Coslow, Republic Industries International